

FULL DEPTH PRECAST CONCRETE DECK PANEL SPECIAL PROVISION



*Refer to Utah Department of Transportation (UDOT)
Full Depth Precast Concrete Panel Manual*

TABLE OF CONTENTS

PART 1	GENERAL.....	2
1.1	SECTION INCLUDES	2
1.2	RELATED SECTIONS	2
1.3	REFERENCES.....	2
1.4	DEFINITIONS.....	3
1.5	SUBMITTALS.....	3
PART 2	PRODUCTS	5
2.1	MATERIALS	5
2.2	CONCRETE CORROSION INHIBITOR ADMIXTURE	7
2.3	PRESTRESSING STRAND, POST TENSIONING AND SHEAR CONNECTORS...7	
2.4	ADHESIVE DOWELLED ANCHORS.....	8
2.5	QUALITY ASSURANCE.....	8
PART 3	EXECUTION	9
3.1	FABRICATION	9
3.2	NEW SHEAR STUDS ON EXISTING STEEL GIRDERS AND CONCRETE BEAMS	9
3.3	PLACING PRECAST CONCRETE DECK PANELS	9
3.4	LONGITUDINALLY POST TENSIONING	10
3.5	INSTALLATION OF HEADED T BARS AND ANCHORS	12
3.6	PREPARATION AND INSTALLATION OF STRUCTURAL NON-SHRINK GROUT	11
3.7	DECK GRINDING	12
3.8	SURFACE PREPARATION	12

**SPECIAL PROVISION
SECTION 03339S**

FULL DEPTH PRECAST CONCRETE DECK PANELS

Delete section 03339 in its entirety and replace with the following:

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. This work consists of furnishing, erecting, and installing all precast concrete deck panels including all necessary materials and equipment to complete the work as shown on the plans. The use of cast in place concrete will not be considered for substitution of precast panels.
- B. Procedures for preparing and installing structural non-shrink grout.
- C. Placing structural non-shrink grout into the camber strips, filling the shear stud blockouts and, all other blockouts in the bridge precast concrete deck panels to produce a finished deck.
- D. Procedures relating to preparing bridge(s) for widening and grinding deck panels.
- E. Procedures relating to installing new shear studs on top flanges of existing steel girders and installing shear connectors to the top flanges of existing concrete or prestressed beams as shear studs.

1.2 RELATED SECTIONS

- A. Section 02982: Bridge Concrete Grinding
- B. Section 03055: Portland Cement Concrete
- C. Section 03211: Reinforcing Steel and Welded Wire
- D. Section 03252: Post Tensioning Concrete
- E. Section 03310: Structural Concrete
- F. Section 03372: Thin Bonded Polymer Overlay
- G. Section 03412: Prestressed Concrete

1.3 REFERENCES

- A. UDOT Quality Management Plan
- B. AASHTO/AWS D1.5 2008 Bridge Welding Code

- C. ANSI/AWS C6.1-89: American Welding Society's Recommended Practices for Friction Welding
- D. AASHTO M235: Standard Specification for Epoxy Resin Adhesives
- E. AASHTO T106: Compressive Strength of Hydraulic Cement Mortar
- F. AASHTO T160: Length Change of Hardened Hydraulic Cement Mortar and Concrete
- G. AASHTO T161: Standard Method of Test for Resistance of Concrete to Rapid Freezing and Thawing
- H. AASHTO T260: Standard Method of Test for Sampling and Testing Chloride Ion in Concrete and Concrete Raw Materials
- I. ASTM A108: Standard Specification for Steel Bar, Carbon and Alloy, Cold-Finished
- J. ASTM A109: Standard Specification for Steel Carbon Cold-rolled Strip
- K. ASTM C494: Standard Specification for Chemical Admixtures for Concrete
- L. ASTM A706: Standard Specification for Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement
- M. ASTM E274: Standard Test Method for Skid Resistance of Paved Surfaces Using a Full-Scale Tire
- N. ASTM E1512: Standard Test Methods for Testing Bond Performance of Bonded Anchors
- O. PCI Design Handbook, Fifth Edition with all Interims and Errata

1.4 DEFINITIONS NOT USED

1.5 SUBMITTALS

- A. The submittal requiring written approval from the Engineer are either shop drawings or working drawings.
 - 1. Shop Drawings:
 - a. Submit five (5) sets half-size, 11½ x 17 inch sheets with a 1½-inch blank margin on the left-hand edge.
 - b. Place the project designation data in the lower right-hand corner of each sheet.
 - c. Shop drawings prepared and stamped by Professional Engineer licensed in Utah.
 - d. Show all lifting inserts, hardware or devices and location on the shop drawings for Engineer's approval.
 - e. Begin fabrication only after approval has been granted.

- f. The Department rejects units fabricated before receiving written approval.
 - g. Submit a Certificate of Compliance of non-shrink grout to Engineer for approval.
 - h. Engineer reserves the right to retain these drawings up to 14 calendar days without granting an increase in the number of working days on the project. This is reduced to 7 days when the drawings are submitted electronically. This right applies each time the drawings are submitted.
2. Working Drawings:
- a. Submit five (5) sets half-size, 11½ x 17 inch sheets with a 1½-inch blank margin on the left-hand edge.
 - b. Place the project designation data in the lower right-hand corner of each sheet.
 - c. Working drawings and supporting calculations prepared and stamped by a Professional Engineer licensed in Utah.
 - d. All handling and erection bracing will conform to Chapter 5 of the PCI Design Handbook.
 - e. Working drawings will include, but are not limited to show the following:
 - 1. Minimum clearances to panel edges.
 - 2. Locations and details of the lifting devices, including supporting calculations.
 - 3. Type and amount of any additional reinforcing required.
 - 4. Calculations showing tensile stresses on both faces do not exceed the modulus of rupture as a result of handling during fabrication, shipping, and erection.
 - 5. Minimum compressive strength attained prior to handling the panels.
 - 6. Load distribution
 - 7. Cables and lifting equipment
 - 8. Details of vertical adjusting hardware
 - f. Erection Plan submission will include details showing the removal of the existing deck (if applicable), and the erection and installation of the proposed deck panels in accordance with the design plans.
 - g. Submit erection plan including, but not limited to the following information:
 - 1. Locations of cranes and pick locations.

2. Crane charts.
 3. Panel erection and sequence.
- h. Submit a proposed method for forming the camber strips and installing the structural non-shrink grout, sequence, and equipment for grouting operation to Engineer for review. Obtain approval prior to placing structural non-shrink grout begins.
 - i. Submit a method of forming closure pours at joints between precast panels.
 - j. Engineer reserves the right to retain these drawings up to 14 calendar days without granting an increase in the number of working days on the project. This is reduced to 7 days when the drawings are submitted electronically. This right applies each time the drawings are submitted.
- B. See Section 03252: Post Tensioning Concrete for additional submittal requirements

PART 2 PRODUCTS

2.1 MATERIALS

- A. Mild Reinforced Panel: Use Class AA (AE) concrete for precast concrete deck panels as specified in Section 03055 and on the plans. Submit substitutions for self-consolidating concrete mix designs to Engineer for approval as an alternate to the structural concrete for the precast deck panels.
- B. Prestressed Panel: Use Class AA (AE) concrete according to Section 03055, except as modified by Section 03412 for Prestressed Concrete Panels. Submit substitutions for self-consolidating concrete mix designs to Engineer for approval as an alternate to the structural concrete for the precast deck panels. Use nominal aggregate of 3/4".
- C. Use coated reinforcing steel as specified in Section 03211.
- D. Use mechanical threaded couplers when specified for precast concrete deck panel reinforcing as specified in Section 03211. Do not use lap splices for mild reinforcement or post-tension bars within the panel. Lap splices are acceptable in cast-in-place closure pours.
- E. Use structural non-shrink grout for camber strips, shear stud blockouts, keyway blockouts, and other blockouts shown on the plans.
 1. Use a mix design in accordance with the requirements of Section 03055 if adding more than 15 lb of coarse aggregate (size No. 8) or larger per 50 lb bag of structural non-shrink grout.

2. Mix structural non-shrink grout just prior to use, in accordance with the manufacturer's instructions.
3. Use non-shrink grout concrete gray in color and containing no calcium chloride or admixture containing calcium chloride or other ingredient in sufficient quantity to cause corrosion to steel reinforcement.
4. Follow manufacturer's recommendation for dosage of corrosion inhibitor admixture.
5. Use quick-setting, rapid strength gain, non-shrink, and high-bond strength grout.
6. Warranty the in-place structural non-shrink grout performance and workmanship for two (2) years.
7. Repair or refund at the Department's option any bonding failures that occur during the warranty period.
8. Refer to Table 1 for structural non-shrink grout requirements.

Table 1

Structural Non-Shrink Grout			
*Properties	Requirements	ASTM	AASHTO
Accelerated Weathering	As Specified in ASTM or AASHTO	C666	T260
Compressive Strength	>5,000 psi @ 24 Hours		T106
Accepted Bond Strengths	>1,000 psi @ 24 Hours	C882 or C1042	
Test Medium	<3% White Utah Road Salt		T161
Accepted Weight Loss	<15% @ 300 Cycles		T161
Friction Number	>40	E274	
Shrinkage	No expansion after 7 days		T160

*Certified test results from a private AASHTO accredited testing laboratory will suffice for acceptance.

- F. Use a UDOT Certified Concrete Precaster or a pre-qualified project site caster for concrete products in accordance with the Department Quality Management Plan: Precast-Prestressed Concrete Structures.
- G. Prior to stripping the forms, the precast panels will have a minimum compressive strength of 500 psi. Continuously wet cure the precast panels for 5-days commencing immediately after final finishing with all exposed surfaces covered. The precast panels will have a minimum cure of 28 days prior to placement.
- H. Supply test data (slump, air voids, unit weight) for the fresh concrete, and compressive strengths for the hardened concrete after 7, 14, and 28 days (if applicable).

- I. Post-Tensioning: Stressing will not commence until the concrete reaches the specified strength and age designated on the plans. Stress strands within 72 hours of panel placement and transverse joint grouting to minimize early age concrete shrinkage cracking.
- J. Design and show all post-tensioning hardware and blockouts if required. Manufactured designed proprietary hardware is acceptable with approval of the Engineer.

2.2 CONCRETE CORROSION INHIBITOR ADMIXTURE

- A. The concrete corrosion inhibitor admixture will contain a minimum of 30% calcium nitrite by mass and formulated to meet ASTM C494 requirements for Type C, accelerating admixture.
- B. Use a dosage rate of four (4) gallons per cubic yard unless otherwise directed by the manufacturer.
- C. Use the admixture in all new concrete and grout placed.

2.3 PRESTRESSING STRAND, POST TENSIONING AND SHEAR CONNECTORS

- A. See Section 03412: Prestressed Concrete for requirements.
- B. See Section 03252: Post Tensioning Concrete for bar, strand, grout and other requirements.
- C. New shear studs will be made from cold-drawn bars, Grades 1015, 1018 or 1020, either semi or fully killed, conforming to AASHTO M 169 Standard Specification for Steel Bars, Carbon, Cold-Finished, Standard Quality, and have a minimum tensile strength of 60.0 ksi.
 - 1. Use headed anchor studs for shear connectors conforming to dimensions showing on the plans. Use steel conforming to the requirement of AASHTO M169. Automatically end weld studs in the shop or field with equipment designed for stud welding operations. Use equipment having capacity adequate for the size of stud welded.
- D. If flux-retaining caps are used, the steel for the caps will be of a low carbon grade suitable for welding and will conform to ASTM A109 – Standard Specification for Steel, Carbon, Cold-Rolled Strip.

E. On Concrete girders

1. T- Headed bars consist of deformed rebar with steel plates friction-welded to one end of the rebar.
2. The deformed rebar conforms to ASTM A706, Grade 60.
3. Cut plate heads from flats of hot-rolled steel conforming to ASTM A108.
4. Use an approved epoxy grout to develop minimum pullout strength in T-headed bar anchorage as shown on the Plan.

2.4 ADHESIVE DOWELED ANCHORS

- A. Epoxy resin adhesive for anchors will conform to AASHTO M235 Standard Specification for Epoxy Resin Adhesives.

2.5 QUALITY ASSURANCE

- A. Department pre-qualifies pre-cast and site-cast manufacturers according to the UDOT Quality Management Plan: Pre-cast/Prestressed Concrete Structures.
- B. Permanently mark each precast unit with date of casting and supplier identification. Stamp markings in fresh concrete.
- C. Prevent cracking or damage during handling and storage of precast units.
- D. Defects and Breakage Prestressed and Nonstressed Members .
1. Members that sustain damage or surface defects during fabrication, handling, storage, hauling, or erection are subject to review and rejection. Submit proposed written repair procedures and obtain approval before performing repairs. Repair work must reestablish the member's structural integrity, durability, and aesthetics to the satisfaction of the Engineer. When damage occurs, determine the cause and take corrective action. Failure to take corrective action, leading to similar repetitive damage, could be cause for rejection of the damaged members. Cracks that extend to the nearest reinforcement plane and fine surface cracks that do not extend to the nearest reinforcement plane but are numerous or extensive are subject to review and rejection. Full depth cracking and breakage greater than 1 foot are cause for rejection.
- E. Construct panels to tolerances shown on the Plans.

PART 3 EXECUTION

3.1. FABRICATION

- A. Do not place concrete in the forms until the Engineer has inspected and approved the placement of all materials in the deck panels.
- B. Finish the precast concrete deck panels following Section 03310.
- C. Perform prestressing in accordance to Section 03412 Prestressed Concrete.

3.2. NEW SHEAR STUDS ON EXISTING STEEL GIRDERS AND CONCRETE BEAMS

- A. Installation of the Shear Connectors
 - 1. Install shear connectors at the locations shown on the plans.
 - 2. Weld shear studs to steel girders or plates embedded in prestressed concrete in accordance with applicable AWS specifications. Adjust studs as necessary to provide clearance for bolts in existing bolted splices. Use method and equipment recommended by the manufacturer of the studs and approved by the Engineer. Studs will be field welded. Friction welding conforms to the approved quality control manual and the American Welding Society's Recommended Practices for Friction Welding ANSI/AWS C.6.1-89.
 - 3. Field drill holes in existing concrete and prestressed concrete beam's top flange and install shear studs in accordance with manufacturer's recommendations. Use method and equipment recommended by the manufacturer of the studs, epoxy grout, and approved by the Engineer.

3.3. PLACING PRECAST CONCRETE DECK PANELS

- A. Fully brace concrete beams or steel girders prior to placing of panels.
- B. Place the precast concrete deck panels as shown on the plans or approved working drawings.
- C. Adjust leveling devices to bring panels to the elevations shown on the Plans. Torque all leveling devices to within 15% of each other to ensure proper distribution of panel weight to the supporting beams.
- D. Prevent shifting of the precast concrete deck panels during the joining of all the deck panels.

3.4. LONGITUDINAL POST TENSIONING

- A. Clean and remove all debris from blockouts.
- B. Set final elevations after all panels are in place.
- C. Grout shear keyway between panels.
- D. Do not post tension until the shear key grout has attained a compressive strength of 500 psi (based on manufacturers data).
- E. Install strands as shown on the plans.
- F. Fully tension and grout all ducts in accordance to Section 03252 Post Tensioning Concrete.
- G. Visually inspect the installation of all shear studs and connection details. Place structural non-shrink grout in the girder camber strips and shear stud blockouts in a continuous operation within a section a minimum of 28 days from panel fabrication. Complete without voids.

3.5 INSTALLATION OF HEADED T BARS AND ANCHORS

- A. Adhesive doweled anchors:
 - 1. Use reinforcing, bar dowels, reinforcing bars, threaded rods, bolts etc. as shown in the plans, which is to be adhesive dowelled into concrete.
 - 2. Drill, brush, clean all holes, and install all anchors in complete accordance with manufacturers published recommendations, as well as all applicable building codes or Engineering reports.
 - 3. Continuous inspection is required for installation of reinforcement or threaded rods.
 - 4. Adhesive anchors will be installed and tested in accordance with the epoxy anchor test schedule and as follows:
 - a. Test through the blockout is at the contractor's risk. Repair the damaged panel per the Engineer's instructions or the panel will be rejected. Repair the damaged beams or girders per the Engineer's instructions.
 - b. Test 25% of the first 40 anchors installed and 10% of all anchors installed thereafter.
 - c. If any failures occur, test the previous ten (10) anchors installed as well as the next five (5) anchors installed.
 - d. Allow anchors to cure 48 hrs prior to testing.
 - e. Tension test will be in accordance with ASTM E1512.
 - f. Provide minimum capacity as defined in table below.

Epoxy anchor test schedule					
Schedule for anchors installed in hard rock concrete (2000 psi min. Strength)					
Bar size	Reinforcing bars ($f_y = 60$ ksi)		Bolts or threaded rods ($f_y = 36$ ksi)		
	Minimum embedment	Tension test load (0.9 f_y)	Anchor diameter	Minimum embedment	Tension test load*
#4	6"	10800#	3/8"	5"	3384#
#5	7"	16700#	1/2"	7"	5400#
#6	9"	23800#	5/8"	8"	9390#
#7	10"	32400#	3/4"	10"	13530#
#8	12"	42700#	7/8"	12"	18417#
#9	13"	54000#	1"	13"	24050#
#10	16"	68600#	1 1/4"	15"	37580#
#11	18"	84200#			

Notes: * allowable loads equal 1/2 test load values

3.6 PREPARATION AND INSTALLATION OF STRUCTURAL NON-SHRINK GROUT

- A. Clean and remove all debris from the camber strips and blockouts prior to placement of the structural non-shrink grout.
- B. Keep bonding surfaces free from laitance, dirt, dust, paint, grease, oil, rust, or any contaminant other than water.
- C. Prior to construction of the deck, pre-test the grout material installation under field conditions in a grout pocket and camber strip mock-up to determine the flowability of the grout, and whether subsequent cracking will occur. The mock-up should include at least two shear connector pockets and a camber strip that is of the same configuration as the actual bridge.
 1. The corrective action will be at the discretion of the Engineer.
 2. Proceed with grouting process at the direction of the Engineer.
- D. Saturate surface dry (SSD) all surfaces receiving structural non-shrink grout.
- E. Mix and place product following manufacturer's recommendations preparation and installation.
- F. Cure structural non-shrink grout per manufacturer's recommendation.
 1. Contact the manufacturer's representative for advice on how to reduce heat such as wet curing or adding retarding admixture if the heat of hydration is excessive.

- G. Repair or refund at the Department's option any bonding failures that occur during the warranty period.
- H. Finish grout flush or a maximum of 1/8 inch above adjacent panels.
 - 1. Correct blockout and void profiles in excess of 1/8 inch higher than the adjacent panel through surface grinding
 - 2. Correct blockout and void profiles below the top of the adjacent panels through removal and replacement of the blockout or void.
 - 3. Pay for any corrections to the finish of the blockout or void at no additional compensation.

3.7 DECK GRINDING

- A. Profile grind the deck and approaches after all panels are in place, grouting is complete and design strength is achieved see Section 02982: Bridge Concrete Grinding.

3.8 SURFACE PREPARATION

- A. Prepare deck and approach slabs then place Polymer Overlay, Type 1. See section 03372: Thin Bonded Polymer Overlay.

END OF SECTION